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Discussion paper

DOES THE EUROPEAN FINANCIAL STABILITY FACILITY BAIL OUT SOVEREIGNS OR BANKS? AN EVENT STUDY

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Does the European Financial Stability Facility bail out sovereigns or banks?

An event study

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Abstract: On May 9, 2010 euro zone countries announced the creation of the European Financial Stability Facility as a response to the sovereign debt crisis. This paper investigates the impact of this announcement on bank share prices, bank CDS spreads and sovereign CDS spreads. The main private beneficiaries were bank creditors, especially of banks heavily exposed to southern Europe and Ireland and located in countries characterized by weak public finances. Furthermore, countries with weak public finances and banking systems heavily exposed to southern Europe and Ireland benefited, as evidenced by lower sovereign CDS spreads. The combined gains of bank debt holders and shareholders exceed the increase in the value of their sovereign debt exposures, suggesting that banks saw their contingent claim on the financial safety net increase in value.

Key words: Bailout, Banking, CDS spreads, Sovereign debt.

JEL classifications: G21, G28, H63

1 Introduction

On Sunday May 9 2010, euro zone politicians, the ECB and the IMF laid out a new strategy to deal with the European sovereign debt crisis. Foremost, the euro zone countries announced the creation of the European Financial Stability Facility (EFSF) which was to provide loans to euro zone countries experiencing refinancing problems. The EFSF would have €440 billion at its disposal, with its own debt guaranteed by the set of euro zone countries. At the same time, the IMF and the European Financial Stabilization Mechanism were to make €250 billion and €60 billion available, respectively, for external support to euro zone countries, bringing the total amount earmarked for such support to €750 billion. Simultaneously, the ECB stated that it was willing to start purchasing euro zone debt in the secondary market in an effort to contain the yields on these instruments.

The EFSF can provide loans only to euro zone governments. The immediate effect of its creation should be to reduce the probability of an imminent default by heavily indebted euro zone countries, possibly at the expense of a somewhat higher probability of default of non-recipient, euro zone countries that guarantee the EFSF debt.

European banks can be materially affected by the new EFSF as well. European banks hold large portfolios of European sovereign debt, and the market value of these debts is impacted immediately by a change in the creditworthiness of euro zone governments. More indirectly, European banks rely on their national governments for bailout support in case they experience financial distress. The EFSF increases the access to finance for heavily indebted euro zone countries, thereby making it more likely that these countries can support their distressed banks. However, the EFSF reduces the residual fiscal capacity of its guarantor countries, possibly reducing the value of their financial safety nets to their resident banks. This suggests that the impact of the EFSF on euro zone banks depends on the size and composition of their sovereign debt portfolios and also on their country of residence.

The announcement of the EFSF triggered sharp reactions in financial markets. European bank share prices rose sharply on the Monday after the announcement, to give back gains in the following days. CDS spreads on bank liabilities and on sovereign debts, in turn, fell immediately and remained at lower levels in subsequent trading sessions.

This paper presents an event study of the impact of the EFSF announcement on bank share prices, bank CDS spreads, and sovereign CDS spreads. In particular, we relate movements

in these market prices to data on bank-level sovereign debt portfolios, as made available by the Committee of European Bank Supervisors (CEBS) following EU-wide bank stress tests in early 2010, and to government finance variables. The bank stock excess return regressions are based on a sample of 46 European banks, while the bank CDS regressions use data for 32 banks. The sample of country-level CDS spreads contains 18 observations.

Our main results are as follows. Bank stock excess returns are positively and significantly related to bank exposures to Portugal, Ireland, Italy, Greece, and Spain (the PIIGS countries), and not to other EU sovereign exposure. Further, bank stock excess returns for banks located outside the euro zone countries are positively related to a country's government debt-to-GDP ratio and its public deficit-to-GDP ratio. This could reflect that countries with weak public finances offer financial safety nets to their banks with relatively low valuations as implicit in bank share prices. An increase in the quality of a bank's sovereign debt portfolio, following the EFSF announcement, may therefore lead to a relatively small offsetting reduction in the valuation of the financial safety net of banks located in countries with strained public finances. For euro zone banks, in contrast, we find that bank stock excess returns are negatively related to the government debt and deficit ratios, perhaps because bank stock investors expected bailouts of heavily indebted euro zone countries that would be more favorable to them. Banks located in the euro zone are estimated to have benefited more from the EFSF announcement than banks located in non-euro zone countries, with the exception of banks located in the euro zone countries with the highest government-debt and deficit ratios.

Changes in bank CDS spreads, in turn, are negatively related to banks' PIIGS sovereign exposures, but they are positively related to banks' non-PIIGS euro zone sovereign exposures. This is evidence that the EFSF announcement led to an increased valuation of PIIGS debt as reflected in bank CDS spreads, and to a reduced valuation of non-PIIGS euro zone debt. This may reflect that the creation of EFSF improved the repayment prospects for PIIGS countries, at the expense of reduced repayment prospects for non-PIIGS countries. Bank CDS spreads further decline more, if a bank is located in a country with weaker public finances.

Similarly, sovereign CDS spreads decline with a national banking system's exposure to PIIGS sovereign debt, while they increase with a national banking system's exposure to non-PIIGS debt. Sovereign CDS spreads in addition decline relatively much for euro countries with weak public finances. This is further evidence that the EFSF transferred creditworthiness to

PIIGS countries with weak public finances, possibly at the expense of the creditworthiness of non-PIIGS euro zone countries.

On the basis of our regression output, we can calculate the change in the values of banks' assets, shares and liabilities insofar as these depend on a bank's PIIGS sovereign exposure. Interestingly, the calculated combined change in the value of banks' shares and liabilities far exceeds the calculated change in the value of banks' PIIGS exposures themselves. The creation of the EFSF thus appears to have benefited investors with claims on banks beyond the increase in the valuation of sovereign debts in bank portfolios. This suggests that bank stock and liability holders collectively benefit from lower expected costs of bank distress or higher expected payouts from national financial safety nets.

Several papers have previously examined market reactions to national bank bailouts. Ejsing and Lemke (2009) show that the decline in banks' CDS spreads upon the announcement of rescue packages by European governments in 2008 were accompanied by sovereign CDS spread rises, as investors may have perceived the bailouts as credit risk transfers from the private to the public sector. They also show that both bank and sovereign credit risk is associated with a common (Europe-wide) macroeconomic factor, to which the sensitivity of bank (sovereign) CDS spreads declined (increased) after the bailout announcements. Attinasi et al. (2009) also document private-to-public credit risk transfers induced by European bank bailout announcements, and they find that the size of the packages is not significantly correlated with changes in risk spreads. They interpret this result as a sign that investors regard the packages as commitments to bail out banks, regardless of the size of the present interventions.

King (2009) carries out an event study of rescue package announcements in six countries, including the United States, after the Lehman default. Comparing abnormal stock market movements of bank shares and CDS spreads, he finds that government interventions primarily benefited creditors, whereas stock prices continued to decline after an initial increase in most countries. The exception is the US, where shareholders saw increased valuations, which the author attributes to more favorable conditions of the US bailout. The BIS (2009) reaches a similar conclusion in its comprehensive analysis of the rescue packages seen between October 2008 and April 2009 in ten countries. These bailouts were associated with declining bank CDS spreads, but stock prices dropped as well. This suggests that the rescue packages were successful at decreasing expected credit losses on bank liabilities. However, the interventions decreased

existing shareholders' earning and voting rights, and might have lowered the expected profitability of banks.

Sgherri and Zoli (2009) look into the determinants of European sovereign CDS spreads. They find that spread changes are primarily driven by a common time-varying factor, closely related to global risk appetite, but that since the beginning of 2009 markets have become more concerned about the fiscal consequences of potential bailouts of the domestic financial system and future debt dynamics. Similarly, Gerlach and Schulz (2010) find that sovereign bond spreads are determined by an aggregate risk factor and its interactions with indicators of the size and structure of national banking sectors. Specifically, when aggregate risk increases countries with large banking sectors and low equity ratios experience a greater widening in yield spreads. Dieckmann and Plank (2011), in turn, find that a country with a larger financial sector faces higher CDS spreads – even after controlling for sovereign leverage, i.e. the government debt to GDP ratio. Furthermore, sovereign CDS spreads move together with the health of the financial system – this is true for local and global shocks to the financial sector.

The two-way feedback between the banking system and the public finances is the focus of Acharya et al. (2011), who provide a theoretical model of how banking and sovereign CDS spreads are interrelated. Bank bailouts lead to a deterioration of the public finances, and they increase the incentives to default on sovereign debt. In the model, a large outstanding amount of government debt lowers a government's ability to undertake a bailout, and at the same time it increases the probability of sovereign default. Panageas (2010a, b) considers bank bailouts in an optimal taxation framework, yielding that a government may wish to bail out a bank to prevent the deadweight losses associated with a bank collapse.

Demirgüç-Kunt and Huizinga (2010) provide empirical evidence that banks may have become too big to save. They find that bank valuation is negatively related to public deficits for systemically large banks, while banks' CDS spreads are positively related to public deficits. These results suggest that countries are experiencing fiscal constraints in providing a financial safety net to their banks.

The remainder of this paper is as follows. Section 2 discusses the data, and section 3 presents the empirical results. Section 4 provides some calculations of the impact of the creation of the EFSF on the absolute values of bank shares, bank liabilities, and bank sovereign portfolios. Section 5 concludes.

2 The data

We obtain data on banks' exposures to government debts of EU member states from the EU-wide stress tests conducted under the auspices of the Committee of European Banking Supervisors in early 2010. The stress tests covered 91 European banks, representing 65% of the European banking market in terms of assets. Our exposure data are net of impairment and cover debt held in both the trading book and the bank book. The exposure data and other balance sheet variables used in this study reflect consolidated statements. We restrict ourselves to banks that are publicly listed, which reduces the sample to 46 banks. Table 1 provides information about banks' sovereign exposures aggregated by country of residence. Banks located in the UK have the largest aggregate sovereign exposure of €216 billion, followed by Italian and German banks with €165 billion and €145 billion, respectively.

We can divide a bank's sovereign exposure by its total assets to obtain a measure of its relative exposure. As seen in Table 1, banks in Austria, Belgium, Greece, Hungary, Poland, and Malta have an exposure-to-assets ratio exceeding 6 percent, while the average sovereign exposure-to-assets ratio is 2.31 percent for the 18 countries in the table. Sovereign debt-to-assets ratios for the 46 individual banks in our sample are provided in Table A1 in the Appendix.

Bank stock excess returns are calculated using stock price value data obtained from Datastream for one-day, three-day, and five-day event windows centered on the event date of May 10, 2010. Specifically, we calculate excess return, er_L^i , of bank i for an event window of L days using the following formula:

$$er_L^i = \ln \left(P_{t+0.5(L-1)}^i / P_{t-0.5(L+1)}^i \right) - \beta^i \ln \left(P_{t+0.5(L-1)}^{MSCI} / P_{t-0.5(L+1)}^{MSCI} \right)$$

where P_s^i is the closing market value of bank i on day s in euros, and t is the event day of May 10, 2010. In this expression, β^i is the estimated market beta of bank i based on a 6-month sample of daily returns in the period from the beginning of October 2009 to the end of March 2010. As a proxy for the market portfolio, we use the MSCI World Index in euros.¹

¹ We calculate excess returns relative to a worldwide stock market index, as the event had a material effect on national market indices.

As measures of changes in bank and sovereign debt values, we use CDS spread changes over the event windows.² We use CDS spreads on senior unsecured bonds for five-year contracts, as these contracts are the most liquid. Also, we restrict the sample to CDS contracts with a modified restructuring (MR) clause in the case of banks following Jorion and Zhang (2007).³ This yields a sample of 32 bank CDS spread changes, and a sample of 18 sovereign CDS spread changes for EU countries where at least 1 of the 46 banks in our sample is located. All CDS spread data are taken from Datastream. In the regressions, the five-year sovereign CDS spread as of the pre-event date of May 5, 2010 will be used as an index of national creditworthiness and fiscal capacity.

At the country level, we use two additional indices of the health of public finances. First, government debt is the consolidated gross debt of the general government as a percentage of GDP at the end of 2009. Second, fiscal deficit is the net borrowing of the general government as a percentage of GDP at the end of 2009. Government debt and fiscal deficit figures are from Eurostat. Finally, we construct dummy variables for both banks and countries that indicate whether a bank is located in a euro zone country, or whether a country is a euro zone member country.

Figure 1 plots the average excess returns for banks located in PIIGS countries and other EU countries during the period of April and May of 2010 surrounding the event day of May 10. Bank share prices declined sharply especially in PIIGS countries in April and early May prior event day. On the event day, bank stocks experienced excess returns of on average 7.6 percent for the 46 banks in our sample, with bank shares in PIIGS countries rising relatively much. However, bank share prices reversed their gains in subsequent days. Over a three-day event window, the average bank stock excess return had declined to 3.7 percent, while over a five-day event window it even became negative at -1.4 percent. The reversal of the immediate bank share gains following the announcement cannot be explained by additional news with severe negative implications for bank valuations, as is evident from a summary of news items surrounding the event day of May 10, 2010 provided in A2 in the Appendix. Instead, the reversal of initial bank stock gains appears to reflect a reappraisal of the implications of the announcement itself for

² We do not work with abnormal or excess CDS spread changes, as the announcement might have had a significant effect on CDS spread indices.

³³ Modified restructuring clauses are part of the ISDA documentation since 2001. MR limits the maturity of obligations to be delivered after the credit event.

bank valuation. Similar patterns of stock price movements after the announcements of national bank rescue packages in the fall of 2008 are noted by King (2009) and the BIS (2009). In all these instances, bank stock investors appear to have concluded that the bailouts primarily are to the benefit of bank creditors.

In analogous fashion, Figure 2 plots the development of average CDS spreads for banks located in PIIGS countries and other EU countries during April and May of 2010. Throughout this period, banks located in PIIGS countries have significantly higher CDS spreads than banks located in other EU countries. CDS spreads for both groups of banks rose sharply prior to the event day, to decline subsequently. The one-day decline in average bank CDS spread following the event was 38.0 basis points. Over three-day and five-day event windows, the declines in average bank CDS spreads were somewhat smaller at 23.1 basis points in both instances.

In Figure 3, we display the average country-level CDS spreads for PIIGS countries and other EU countries during April and May of 2010. As in the case of bank CDS spreads, average country CDS spreads rose sharply before the event day and fell off significantly afterwards, especially for PIIGS countries. In fact, the developments of average bank and country CDS spreads in Figures 2 and 3 for PIIGS countries and non-PIIGS countries are remarkably similar, indicating that market operators see the fortunes of banks and their countries of residence as tightly linked.⁴ The average decline in country CDS spreads over one-day, three-day, and five-day event windows is rather stable at 55.0, 59.4 and 53.9 basis points, respectively.

Table 2 provides formal tests of whether the mean bank excess returns, and changes in bank and country CDS spreads over the various event windows are different from zero. Interestingly, the mean bank excess return of -1.4 percent over the five-day window is only significantly different from zero at the 10 percent level. The declines in bank and country CDS spreads over this event-window, in contrast, are both significant at the 5 percent level.

To conclude this section, Figure 4 provides plots of bank excess returns and bank and country CDS spreads during April and May 2011 for 8 selected EU countries: France, Germany, Greece, Ireland, the Netherlands, Portugal, Spain, and the United Kingdom. The individual-country pictures show some dispersion among the effects of the event on bank excess returns. In particular, bank excess returns for 4 non-PIIGS countries (France, Germany, Netherlands, and

⁴ See also Sgherri and Zoli (2009) and Dieckmann and Plank (2011) for evidence on the co-movement of bank and country CDS spreads at a time of financial crisis.

the United Kingdom) are higher at the end of May than just prior to the event, while bank excess returns continued to decline in Greece and Ireland after the event. The individual-country pictures confirm that both bank and country CDS spreads increased gradually during April. Greek sovereign CDS spreads, in particular, increased from an initial 352 basis points on April 1 to 893 basis points on April 27, when Standard & Poor's downgraded Greek debt to junk status. During the same period, the insurance cost of German sovereign risk climbed from 31 basis points to 52 basis points, a remarkable 67% increase. After the event, bank and country CDS spreads tended to decline, although we see that the CDS spread for Ireland continued to climb.

Table 3 provides descriptive statistics and correlation matrices for variables used in the bank stock excess return regressions (in Panel A), the bank CDS change regressions (in Panel B), and the sovereign CDS change regressions (in Panel C). The table indicates that the bank exposure and national government debt variables are positively correlated. In particular, in Panel A we see that the correlation between total bank exposure to government debt relative to assets and national government debt relative to GDP is 0.47.

3 Regression results

In this section we present results of regressions of bank excess returns, bank CDS spread changes and country CDS spread changes in turn.

3.1 Bank stock excess returns

In Table 4, the dependent variable is the bank stock excess stock return calculated over a five-day event window. Standard errors control for clustering at the country level. In regression 1, the bank stock excess return is related to a bank's total EU sovereign debt exposure relative to bank assets, yielding a positive coefficient of 0.338 that is statistically insignificant. Regression 2 includes separate variables for a bank's sovereign exposures to PIIGS countries, non-PIIGS euro zone countries, and non-euro zone countries, all relative to assets. In this regression, the PIIGS exposure variable obtains a coefficient of 0.726 that is significant at 1 percent, while the other two exposure variables obtain insignificant coefficients.⁵ The estimated coefficient of 0.726

⁵ We obtain similar results if we include only one of the exposure variables at a time (unreported).

implies that an increase in the PIIGS variable by one standard deviation of 0.03 (as seen in Table 3, Panel A) is estimated to increase the bank excess return by 0.022 ($=0.726 \times 0.03$), which is about half the standard deviation of the excess return of 0.05. Thus, the impact of a bank's PIIGS exposure on its excess return is economically significant.

Regression 3 includes national government debt-to-GDP ratio. This variable obtains an insignificant coefficient, while the coefficients for the exposure variables remain largely unchanged. Alternatively, regression 4 includes the fiscal deficit-to-GDP, yielding an insignificant estimated coefficient and similar estimated coefficients for the exposure variables. Regression 5 instead includes the sovereign CDS spread as of March 30, 2010. This public finance proxy also obtains an insignificant coefficient, with little impact on estimated coefficients for the exposure variables. Taken together, regressions 3-5 suggest that a bank's stock prices reaction to the EFSF announcement primarily reflects its PIIGS exposure, and not its national public finances.

The EFSF, however, is a vehicle for intergovernmental credits among euro zone countries, which suggests that the relationship between bank excess returns and the national public finances may be different for the set of euro zone countries compared to non-euro zone EU countries. To check this, we re-estimate regressions 3-5 after including a euro zone dummy and an interaction of this dummy with the included public finance proxy. The results are presented as regressions 6-8. In regression 6, we see that the government debt variable obtains a coefficient of 0.001 that is significant at 1 percent. The positive coefficient on the government debt variable suggests that bank excess returns are positively related to government indebtedness for non-euro zone EU countries. To explain this, note that countries with high government debts are less likely to be able to offer their banks generous bailouts, if they become distressed. Thus, there is limited potential for the contingent claims that banks have on the financial safety nets of countries with weak public finances to be reduced if underlying asset values rise. Hence, an increase in the valuation of the sovereign debts of heavily indebted euro zone countries following the EFSF announcement may increase bank stock prices relatively much in non-euro zone EU countries with high government debts.

In regression 6, the interaction of the government debt variable with the euro zone dummy obtains a coefficient of -0.002 that is significant at the 1 percent level. The sum of the coefficients on the government debt variable and its interaction term with the euro zone dummy

is negative at $-0.001 (= 0.001-0.002)$. For euro zone countries, we thus find that bank stock excess returns are negatively related to government indebtedness. A potential reason is that bank stock investors in heavily indebted euro zone countries were disappointed by the scale and scope of the EFSF, as they realized that any benefits from EFSF would accrue disproportionately to bank debt holders rather than to bank shareholders. The euro zone dummy in regression 6 obtains a positive coefficient of 0.186 that is significant at 1 percent. The coefficients on the euro zone dummy and its interaction with the government debt variable together suggest that a bank located in the euro zone benefited from the creation of EFSF relative to a bank outside the euro zone if government debt is less than 93 percent of GDP. This implies that banks located in the average euro zone country, with a debt-to-GDP ratio of 63 percent, benefited from the EFSF relative to banks in a non-euro zone country, while banks located in Belgium and Greece, with debt-to-GDP ratios of 96 and 127 percent respectively, did not benefit.

In regression 7, the deficit variable obtains a positive coefficient of 0.005 that is significant at 1 percent. Hence, bank stock excess returns for banks located outside the euro zone are estimated to be positively related to the country's deficit to GDP ratio, possibly because countries with high deficits cannot afford strong financial safety nets that imply high contingent claims of banks on these systems. The interaction of the financial deficit variable with the euro zone dummy obtains a negative coefficient of -0.007 that is significant at 5 percent, while the euro zone dummy itself obtains a coefficient of 0.086 that is significant at 1 percent. This suggests that within the euro zone banks located in high-deficit countries gained relatively little from the announcement of the EFSF, perhaps because any such deal was expected in some way to be more generous to bank shareholders in high-deficit countries. The estimated coefficients for the euro zone dummy and its interaction with the deficit variable together suggest that banks located in a euro zone country benefited from the EFSF announcement relative to banks located outside the euro zone if the deficit-to-GDP ratio was less than $12.3 (= 0.086/0.007)$ percent. In 2009, Greece and Ireland had deficit-to-GDP ratio of 15.4 and 14.4 percent respectively, which suggests that banks located in these countries did not benefit from the EFSF event relative to banks outside the euro zone.

Finally, in regression 8 the sovereign CDS spread variable and its interaction with the euro zone dummy variable obtain coefficients that are statistically insignificant. The euro zone dummy variable itself, however, obtains a coefficient of 0.064 that is significant at 1 percent,

indicating that banks inside the euro zone benefited from the creation of the EFSF relative to banks outside the euro zone. Overall, our regression results provide some evidence that banks in euro zone countries benefited from the creation of EFSF relative to banks outside the euro zone countries, with the possible exception of banks located in the euro zone countries with the highest debt-to-GDP and deficit-to-GDP ratios.

3.2 Bank CDS spreads

Table 5 shows the results of regressions of 5-year bank CDS spread changes, which are otherwise analogous to the bank stock excess return regressions in Table 4. In regression 1, the total exposure variable is estimated with a negative but insignificant coefficient. In regression 2, bank's total exposure is split up into its PIIGS exposure, its non-PIIGS EMU exposure, and its non-EMU exposure. The PIIGS variable obtains a coefficient of -761.6 that is significant at the 5 percent level, while the other two exposure variables obtain insignificant coefficients. The estimated coefficient of -761.6 implies that a one standard deviation increase in the PIIGS variable of 0.02 (from Table 3, Panel B) reduces the bank CDS spread by 15.23 ($= 761.6 \times 0.02$) basis points, which is about a third of the standard deviation of the CDS spread change of 41.04. Thus, the impact of the PIIGS exposure variable on the bank CDS spread change is economically significant.

In regression 3, we add the government debt variable to regression 2. This public finance proxy obtains an insignificant coefficient, while the estimated coefficient for the PIIGS variable is almost unchanged at -718.9 and significant at 5 percent. Regression 4 includes the deficit variable, yielding insignificant coefficients for this variable as well as the exposure variables. In regression 5, in turn, the CDS spread variable obtains a negative coefficient of -0.193 that is significant at 1 percent, while the three exposure variables obtain insignificant coefficients. Together, regressions 3-5 show some evidence that changes in bank CDS spreads following the EFSF announcement reflect a bank's PIIGS exposure as well as the national public finances of the bank's country of location. However, the paucity of observations and positive correlations of a bank's PIIGS exposure with national public finance variables make it difficult to estimate these various influences on bank CDS spreads precisely.

Regressions 6-8 differ from 3-5 in that they include the euro zone dummy and an interaction term of the euro zone dummy with the included public finance proxy. In regression 6, the PIIGS variable obtains a coefficient of -596.2 that is significant at 5 percent, while the euro zone dummy and its interaction with government debt are statistically insignificant. In regression 7, we see that the fiscal deficit variable obtains a coefficient of 0.321 that is significant at 10 percent, suggesting that the reduction in bank CDS spreads following the event are smaller in non-euro zone countries with relatively high deficits. This is somewhat surprising, as one would expect bank CDS spreads to be relatively sensitive to the quality of a bank's assets if the financial safety net is less creditable on account of high public deficits. The interaction of the deficit variable and the euro zone dummy obtains a negative coefficient of -9.077 that is significant at 1 percent. The large size of this coefficient, compared to the estimated coefficient of 0.321 for the deficit variable, suggests that CDS spreads for banks in euro zone countries declined relatively much in high-deficit countries. A potential reason is that bank CDS spreads are more sensitive to asset quality in countries with high deficits due to the relative fragility of the financial safety net. The euro zone dummy obtains a coefficient of 26.54 that is significant at the 10 percent level. This estimated coefficient and the one for the interaction of the euro zone dummy and the deficit variable together suggest that a bank in the euro zone saw its CDS spread decline relative to a bank outside the euro zone if located in a country with a deficit larger than 2.92 ($=26.54/9.077$) percent. In 2009, these were all euro zone countries, apart from Estonia, Finland and Luxembourg with deficits of 1.7, 2.5, and 0.9 percent, respectively. Finally, in regression 8, we see that the interaction of the CDS spread and the euro zone dummy obtains a coefficient of -0.224 that is significant at 5 percent, to suggest that banks in the euro zone saw their CDS spreads decline relatively much if located in a country with a high sovereign CDS spread, possibly on account of the fragility of the financial safety net in countries with high sovereign CDS spreads.

3.3 Country CDS spreads

Table 6 presents the results of regressions of changes in sovereign CDS spreads in five-day windows around the announcement. The sample contains a limited number of 18 countries where at least one of the banks included in the stress test conducted by the CEBS is located. The

table contains three panels. In Panels A, B and C, the included public finance variable is the government debt, the public deficit and the sovereign CDS spreads, respectively.

In regression 1 of Panel A, sovereign CDS spread changes are related to the total sovereign exposure of resident banks relative to GDP, yielding an estimated coefficient that is statistically insignificant. In regression 2, we include the government debt variable. The government debt variable obtains a coefficient of -2.841 that is significant at the 10 percent level, while the total sovereign exposure of banks is statistically insignificant. A negative relationship between the sovereign CDS change and government debt is to be expected if the EFSF serves to transfer creditworthiness from lowly indebted governments to highly indebted governments.

In regression 3, the total sovereign exposure variable is broken down into exposures to PIIGS, non-PIIGS EMU and non-EMU countries. The PIIGS and non-PIIGS EMU variable obtain negative and positive coefficients, respectively, that are significant at 10 percent. These estimated coefficients may reflect that the EFSF increases the quality of PIIGS debt while reducing the quality of non-PIIGS debt. Regression 4 jointly includes the three debt exposure variables and the government debt variable, yielding a positive coefficient for the non-PIIGS EMU variable that is significant at 10 percent. In regression 5, the government debt variable is the only included explanatory variable, obtaining a negative coefficient that is significant at 10 percent. In regression 6, the government debt variable, the euro zone dummy and its interaction are included, and none of these variables obtains a significant coefficient. Overall, the regressions of Table 6, Panel A provide some evidence that the EFSF reduces CDS spreads of highly indebted countries and countries with banking systems heavily exposed to PIIGS debt rather than non-PIIGS EMU debt.

In Panel B, the government debt variable is replaced by the fiscal deficit variable. The four regressions in Panel B are otherwise analogous to regressions 2 and 4-6 in Panel A. In regression 1 of Panel B, the deficit variable is estimated with a coefficient of -16.285 that is significant at the 1 percent level, indicating that sovereign CDS spreads of high-deficit countries declined relatively much. In regressions 2 and 3, the deficit variable similarly obtains negative coefficients that are significant at 10 and 5 percent, respectively. In regression 4, the interaction of the fiscal deficit and euro zone dummy obtains a negative and significant coefficient, indicating that sovereign CDS spreads declined especially in EMU countries with large public deficits.

Finally, in Panel C, the sovereign CDS spread is the included public finance variable. Throughout, this variable obtains a negative coefficient that is significant at the 1 percent level, indicating that countries with high sovereign CDS spreads saw their CDS spreads fall after the EFSF announcement. In regressions 2, the non-PIIGS EMU exposure variable obtains a positive coefficient that is significant at 5 percent, suggesting that the EFSF announcement may have compromised the quality of non-PIIGS EMU debt. In regression 4, the interaction of the sovereign CDS spread variable and the euro zone dummy is estimated with a negative and significant coefficient. This is evidence that especially EMU countries with high CDS spreads saw their spreads decline subsequent to the EFSF announcement. Overall, Table 6 provides evidence that sovereign CDS spreads declined more in countries with relatively strained public finances, especially if the country belongs to the euro zone. Furthermore, sovereign CDS spreads declined more for countries with banking systems heavily exposed to PIIGS debt.

4 The overall valuation effects of the announcement

In this section we use the regression results and actual market movements to quantify the effects of the event for the market values of bank shares, bank liabilities and bank portfolios of sovereign debts.

Changes in stock valuations are obtained in a standard way: excess returns over the five-day event window are multiplied by the market value of shares at the beginning of the event window.

Changes in the market values of bank liabilities and sovereign debt portfolios are calculated in a somewhat more involved way by capitalizing changes in CDS spreads analogously to Veronesi and Zingales (2010). Specifically, we take the change in the market value of a debt instrument to be the change in the presented discounted value of the cost of insuring the principal against default up to the maturity of the instrument using the CDS market as follows⁶

$$\Delta E = -\Delta I, \tag{1}$$

⁶ We ignore that over the event window the market value of a debt instrument may alternatively have changed due to a change in the risk-free interest rate.

where E is the market value of a debt exposure and I is the market value of insuring against default.

The present value of the insurance cost is

$$I = \sum_{t=0}^T \frac{CDS(t)}{10000} D(t) Q(t) Z(t), \quad (2)$$

where $D(t)$ is the amount of existing debt that will not have matured by time t , $Z(t)$ is the risk free discount factor, $Q(t)$ is the probability of not defaulting up to time t , and T is the maximum maturity of the debt. Note that a division by 10 000 is necessary, because CDS spreads are in basis points. Equations (1) and (2) imply

$$\Delta E = - \left[\sum_{t=0}^T \frac{CDS_1(t)}{10000} D(t) Q_1(t) Z(t) - \sum_{t=0}^T \frac{CDS_0(t)}{10000} D(t) Q_0(t) Z(t) \right] \quad (3)$$

where subscript 1 denotes values after the event, and subscript 0 denotes values before the event.

We assume that the instantaneous probability of default is constant. In this case, we obtain $Q(t)$ from the formula $Q(t) = e^{-t \frac{CDS(t)}{10000(1-\delta)}}$, where δ is the recovery rate in the event of default (see the Appendix of Veronesi and Zingales (2010)). The recovery rate is set to 0.6, which is a standard assumption in CDS markets. For simplicity, we assume a constant risk-free interest rate equal to 2% per annum. The discount factor is then $Z(t) = \exp(-0.02t)$, where t denotes time. We assume that the average maturity of bank liabilities is 5 years for all banks, while that of government bonds is 4 years for all countries.⁷ Further, we assume that in each year the same nominal amount of debt matures, or one fifth of the initial nominal stock of bank liabilities and one quarter of the initial stock of government bonds.

We first consider the changes in the market value of bank portfolios of PIIGS debt and its implication for the market valuation of bank shares and bank liabilities. Specifically, column 1 of Panel A of Table 7 provides the changes in the market value of banks' PIIGS debt – aggregated by country of bank location – using the above methodology. The total change in the market value of PIIGS debt for the 32 banks in our sample (for which we also have CDS spread data) is around 8.7 billion euros.

Column 2 shows our estimates of the changes in the market value of bank liabilities due to exposure to PIIGS sovereign debt. These figures are obtained as follows. Using regression 2 in Table 5 we predict banks' CDS spread changes associated with their PIIGS exposure (as the

⁷ On average these figures seem to be reasonable, see, for example, The Economist, Cutting it fine, May 7, 2011.

product of the coefficient on PIIGS variable and each bank's exposure to this region). We then use equation 3 to obtain an approximation of the change in the market value of bank liabilities. The bank liabilities used in this calculation exclude customer deposits, as the valuation of these liabilities is not expected to change substantially on account of explicit deposit insurance and a high seniority. In the table, we see that the calculated change in the market value of bank liabilities associated with their PIIGS exposure is 12.0 billion euros.

Next, column 3 shows estimates of the change in the market value of bank shares associated with their PIIGS exposure, which is calculated as follows. Using regression 2 in Table 4, we predict the excess returns associated with banks' exposure to PIIGS government debt. The product of these figures and the market values of banks before the event window gives the predicted changes in banks' stock market value. For the entire sample of banks, we calculate the change in market value associated with PIIGS debt to be 4.4 billion euros.

Column 4 adds up the calculated changes in the market values of bank liabilities and shares as related to banks' PIIGS exposure. For the sample as a whole, this total change in the value of debt and equity claims on banks is calculated to be 16.5 billion euros. Interestingly, this increase in the valuation of overall claims on banks as related to their PIIGS exposure is almost double the calculated change in the market value of their PIIGS itself exposure (at 8.7 billion). Some of this difference may be due to lower expected bankruptcy costs for banks as borne by bank shareholders and liability holders. This would represent an efficiency gain due to the announcement. Alternatively, combined bank liability holder and shareholder gains are relatively high, as the event increased the fiscal capacity of distressed countries within the euro zone, thereby increasing the value of the contingent claim that banks in these countries have on their financial safety nets.

Next, we present some calculations of the changes in the valuation of overall sovereign debt portfolios, overall bank liabilities, and overall bank share prices over the five-day event window using only market data. Specifically, column 1 of Panel B of Table 7 provides calculations of the changes in the overall values of banks' sovereign debt portfolios – again aggregated at the level of the country of bank location. The change in the total value of bank sovereign exposures is calculated to be 10.3 billion euros, slightly more than the increase in the value of PIIGS exposures of 8.7 billion euros in column 1 of Panel A. In column 2, we see that the change in the value of overall bank liabilities is calculated to be 29.0 billion euros. In column

3, the change in the market values of the 32 banks is calculated to be -4.0 billion euros. In column 4, we see that the sum of the changes in bank liabilities and bank shares adds up to 25.0 billion euros. This total change in the claims of bank liability and share holders is more than double the change in the calculated value of sovereign exposures. The difference can again be due to reduced expected bankruptcy costs for the banks themselves or a higher value of contingent bank claims on national financial safety nets. The final column in the table provides information on the book values of total bank assets for the banks in our sample. Total assets of these 32 banks amount to 43.1 trillion euros. The calculated change in the total market valuation of bank liabilities and bank shares of 25.0 billion euros amounts to about 0.06 percent of the book value of total assets. All the same, for a badly capitalized bank the change in the market value of its sovereign exposure could be material.

5 Conclusion

This paper examines the impact of the creation of the EFSF on bank share prices, bank CDS spreads and sovereign CDS spreads in the EU using an event study methodology.

Bank share holders and bank liability holders appear to have gained to the extent that their banks held the sovereign debts of PIIGS countries. The gains of bank liability holders in euro zone countries with weak public finances are estimated to be relatively large, while the gains to bank shareholders in such countries are relatively small. The latter result may reflect that bank stock investors in euro zone countries with weak public finances expected bailouts of their countries that would entail larger prospects for keeping bank equity value intact.

The division of the overall gains between shareholders and debt holders was uneven. Banks' creditors, in particular, could book large gains as evidenced by decreased average bank CDS spreads, while bank shareholders suffered negative average excess returns in a five-day event window – after an initial spike in bank share prices immediately after the announcement. The announcement of the EFSF thus appears to have reduced expected credit losses on bank liabilities, while at the same time reducing shareholder value, perhaps because the EFSF announcement did little to reduce bank funding costs for new bank funding.

Interestingly, the combined gains to bank shareholders and bank liability holders are calculated to greatly exceed the increase in the valuation of banks' sovereign debt portfolios.

This suggests that banks benefited from lower expected costs of bank distress, or - more substantially - from increased contingent claims on their national financial safety nets.

Country CDS spreads are found to fall for countries with banks with large PIIGS sovereign exposures. At the same time, sovereign CDS spreads decline for countries with weak public finances.

Overall, our results suggest that the creation of the EFSF represents a direct bailout of heavily indebted euro zone governments and an indirect bailout of EU banks with large exposures to these countries. Other holders of these sovereign debts, and in particular non-EU banks, and institutional and private investors, were bailed out as well – at the expense of euro zone tax payers. The EFSF, as announced in May 2010, thus was a rather crude and expensive way to bail out EU banks with large distressed euro zone sovereign exposures.

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Appendix

Table A1. Sovereign exposure to total assets ratios for individual banks in percent.

The 46 banks in this table correspond to the sample for bank excess return regressions presented in Table 4.

Country	Bank	Sovereign debt exposure to assets in percent
Austria	Erste Group Bank AG	6.08
	Raiffeisen Zentralbank Oesterreich AG (RZB)	7.52
Belgium	Dexia	4.85
	KBC Bank	15.64
	Marfin Popular Bank Public Co Ltd	4.42
Cyprus	Bank Of Cyprus Public Co Ltd	4.09
Denmark	Danske Bank	2.98
	Jyske Bank	1.15
	Sydbank	0.47
Finland	Op-Pohjola Group	1.38
France	Bnp Paribas	0.10
	BPCE Group	11.73
	Credit Agricole Group	1.63
	Societe Generale	1.74
Germany	Commerzbank AG	4.18
	Deutsche Bank AG	1.06
	Deutsche Postbank AG	3.86
	Landesbank Berlin AG	6.88
Greece	Agricultural Bank Of Greece S.A. (Atebank)	15.09
	Alpha Bank	3.88
	EFG Eurobank Ergasias S.A.	5.79
	Piraeus Bank Group	7.96
	TT Hellenic Postbank S.A.	14.41
Hungary	FHB Jelzálogbank Nyilvánosan Működő Rt	5.54
	Otp Bank Nyrt.	6.91
Ireland	Allied Irish Banks Plc	2.64
Italy	Banco Popolare - S.C.	0.09
	Intesa Sanpaolo	5.24
	Monte Dei Paschi Di Siena	1.92
	Unicredit	4.23
	Unione Di Banche Italiane Scpa (UBI Banca)	2.55
Malta	Bank Of Valletta (Bov)	7.34
Netherlands	ING Bank	1.88

Poland	Powszechna Kasa Oszczędności Bank Polski S.A. (PKO)	8.07
Portugal	Banco BPI	6.36
	Banco Comercial Português S.A. (BCP)	1.98
	Espírito Santo Financial Group S.A. (ESFG)	1.27
Spain	Grupo Santander	2.62
Sweden	Nordea Bank	1.94
	Skandinaviska Enskilda Banken Ab (SEB)	2.93
	Svenska Handelsbanken	1.62
	Swedbank	0.09
United Kingdom	Barclays	1.48
	HSBC Holdings Plc	1.68
	Lloyds Banking Group	0.39
	Royal Bank Of Scotland (RBS)	2.57

Table A2. Timeline of events surrounding the creation of the EFSF

Source: Reuters

Date	News item
April 11	Euro zone finance ministers approve a 30 billion Euro aid mechanism for Greece, which Athens declines to activate.
April 22	Eurostat says Greece's 2009 budget deficit was 13.6 percent of GDP, not the 12.7 percent it had reported.
April 23	Papandreou asks for activation of EU/IMF aid.
April 27	Standard & Poor's downgrades Greece's credit rating to junk status. The next day it downgrades Spain's rating because of poor growth prospects. Germany approves a 22.4 billion Euro (\$30 billion) share. The package amounts to 110 billion Euros over three years and is the first rescue of a member of the 16-nation Euro zone.
May 2	Papandreou says Greece has done a deal with the EU and IMF opening the door to a bailout in exchange for extra budget cuts of 30 billion Euros over three years, on top of measures already set.
May 4/5	Public workers in Greece stage a 48-hour strike. Up to 50,000 protest in Athens. Three people are killed when a bank is set on fire.
May 6	Greek parliament approves latest austerity bill.
May 9	The IMF unanimously approves its part of the rescue loans, and provides 5.5 billion Euros immediately. The package consists of 440 billion Euros in guarantees from euro zone states, plus 60 billion Euros in a European debt instrument. The IMF will contribute 250 billion Euros, taking the total to 750 billion Euros, or around \$1 trillion.
May 10	Global policymakers install an emergency financial safety net worth 750 billion Euros to bolster financial markets and shore up the Euro against contagion from the Greek crisis.
May 11	Germany's cabinet approves the biggest national contribution -- 123 billion Euros in loan guarantees -- to the safety net.
May 12	Spanish Prime Minister Jose Luis Rodriguez Zapatero sets fresh spending cuts of 15 billion Euros in 2010 and 2011.
May 13	Portuguese Prime Minister Jose Socrates and opposition leader Pedro Passos Coelho draw up steps to slash the country's deficit, including public sector pay cuts. The deficit, which hit 9.4 percent of GDP in 2009, is targeted to fall to 7.3 percent in 2010 and 4.6 percent in 2011.
May 18	Germany, in an attack on the financial speculation it blames for the debt crisis, announces a unilateral ban on naked short selling of shares in the country's top 10 financial institutions, on Euro government bonds and on related transactions in credit default swaps (CDS).
May 25	Italy's cabinet approves a 24 billion Euro austerity package with the aim of cutting the deficit to 2.7 percent of GDP in 2012 from 5.3 percent in 2009.

May 27	Spain wins parliamentary approval for its 15 billion Euro (\$18.4 billion) austerity package by just one vote.
May 28	Fitch cuts Spain's credit rating by one notch to AA+ from AAA after record levels of household and corporate debt in Spain, as well as mounting public debt.

Table A3. Description of variables

Variable	Description	Source
Exposure (B)	Bank's consolidated net exposure to EU sovereign debt relative to assets	CEBS stress test and Bankscope
PIIGS (B)	Bank's consolidated net exposure to PIIGS sovereign debt relative to assets	CEBS stress test and Bankscope
non-PIIGS EMU (B)	Bank's consolidated net exposure to sovereign debt issued by non-PIIGS euro zone countries relative to assets	CEBS stress test and Bankscope
non-EMU (B)	Bank's consolidated net exposure to sovereign debt issued by EU member states outside the euro zone relative to assets	CEBS stress test and Bankscope
Exposure (C)	Banks' consolidated net exposure to EU sovereign debt at the country level relative to GDP	CEBS stress test and Bankscope
PIIGS (C)	Banks' consolidated net exposure to PIIGS sovereign debt at the country level relative to GDP	CEBS stress test and Bankscope
non-PIIGS EMU (C)	Banks' consolidated net exposure to sovereign debt issued by non-PIIGS euro zone countries at the country level relative to GDP	CEBS stress test and Bankscope
non-EMU (C)	Banks' consolidated net exposure to sovereign debt issued by EU member states outside the euro zone at the country level relative to GDP	CEBS stress test and Bankscope
Excess return	Five-day stock return minus bank beta times return on MSCI world index	Datastream
Bank CDS change	Five-day change in the bank's 5-year CDS spread in basis points	Datastream
Sovereign CDS change	Five-day change in the sovereign's 5-year CDS spread in basis points	Datastream
Fiscal deficit	General government fiscal deficit in 2009 as a percentage of GDP	Eurostat
Government debt	General government outstanding debt at the end of 2009 as a percentage of GDP	Eurostat
Sovereign CDS spread	CDS spread on five-year sovereign bonds as of March 30, 2010 in basis points	Datastream
Euro zone	Dummy variable that equals one if the bank or country is located in a euro zone country, and zero otherwise	

Table 1. Exposure to sovereign debt issued by PIIGS, non-PIIGS and non-EMU countries

This table provides information on exposures to sovereign debts of banks aggregated at the level of EU member states in billions of euros and as a percentage of bank assets.

Country	In billions of euros				As a percentage of total assets			
	EMU		non-EMU	Total exposure	EMU		non-EMU	Total exposure
	PIIGS	non-PIIGS			PIIGS	non-PIIGS		
Austria	2.8	18.5	16.0	37.3	0.49	3.21	2.77	6.47
Belgium	40.0	51.9	20.9	112.7	2.48	3.22	1.30	7.00
Cyprus	2.3	1.0	0.1	3.3	2.75	1.17	0.17	4.09
Denmark	1.4	6.3	18.9	26.6	0.15	0.65	1.96	2.75
Finland	0.1	0.9	0.1	1.0	0.09	1.16	0.13	1.38
France	24.9	55.3	15.8	96.1	0.26	0.57	0.16	1.00
Germany	36.2	96.0	12.7	144.9	0.64	1.70	0.22	2.57
Greece	36.5	0.6	3.3	40.4	6.79	0.11	0.61	7.51
Hungary	0.0	0.3	5.2	5.5	0.00	0.35	6.46	6.81
Ireland	5.5	1.8	2.3	9.6	1.52	0.49	0.63	2.64
Italy	121.0	31.1	13.2	165.2	2.86	0.73	0.31	3.91
Malta	0.0	0.9	0.0	1.0	0.14	6.94	0.26	7.34
Netherlands	10.7	29.1	5.6	45.4	0.44	1.20	0.23	1.88
Poland	0.0	0.0	6.4	6.4	0.00	0.00	8.07	8.07
Portugal	10.4	0.0	2.0	12.4	2.20	0.01	0.42	2.62
Spain	54.1	1.8	4.4	60.3	2.35	0.08	0.19	2.62
Sweden	1.5	15.5	24.4	41.4	0.07	0.67	1.05	1.79
United Kingdom	28.1	122.6	65.1	215.8	0.22	0.94	0.50	1.66
Total	375.5	433.5	216.4	1 025.4	0.85	0.98	0.49	2.31

Table 2. Means tests of bank excess returns and changes in bank and sovereign CDS spreads

This table provides tests of whether mean bank excess returns, bank CDS spread changes and sovereign CDS spread changes as calculated over one-day, three-day and five-day event windows are different from zero. Bank excess return is the bank stock excess stock return. Bank CDS change is the change in the 5-year bank CDS spread. Sovereign CDS change is the change in the 5-year sovereign CDS spread.

	Event window	Sample mean	Standard deviation	t- statistic	p value
Bank excess returns	One day	0.0761	0.0065	11.76	0.000
	Three days	0.0372	0.0051	7.28	0.000
	Five days	-0.0136	0.0073	-1.85	0.071
Bank CDS changes	One day	-37.9591	8.3636	-4.54	0.000
	Three days	-23.1387	6.3975	-3.62	0.001
	Five days	-23.0790	5.7407	-4.02	0.000
Sovereign CDS changes	One day	-54.9585	23.2545	-2.36	0.030
	Three days	-59.4195	25.6265	-2.32	0.033
	Five days	-53.9095	23.8995	-2.26	0.038

Table 3. Descriptive statistics and correlation matrices

This table provides descriptive statistics and correlation matrices for variables used in the bank stock excess return regressions (in Panel A), the bank CDS change regressions (in Panel B), and the sovereign CDS change regressions (in Panel C). Bank excess return is the bank stock excess return over a five-day event window. Bank CDS change is the change in the bank CDS spread over a five-day event window. Sovereign CDS change is the change in the 5-year sovereign CDS spread over a five-day event window. Exposure (B), PIIGS (B), non-PIIGS EMU (B) and non-EMU (B) are a bank's net sovereign debt exposure relative to assets to all EU countries, PIIGS countries, non-PIIGS, EMU countries and non-EMU countries. Government debt is general government debt at the end of 2009 as a percentage of GDP. Fiscal deficit is the general government fiscal deficit in 2009 as a percentage of GDP. Sovereign CDS spread is the five-year sovereign CDS spread on March 30, 2010 of the country in basis points. Euro zone is a dummy variable that equals one if a bank is located in the euro zone, and zero otherwise. Exposure (C), PIIGS (C), non-PIIGS EMU (C) and non-EMU (C) are banks' net sovereign debt exposures to all EU countries, PIIGS countries, non-PIIGS, EMU countries and non-EMU countries aggregated to the country level and relative to GDP. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Panel A. Sample for bank stock excess return regressions

Descriptive statistics	Obs	Mean	Std. Dev.	Min	Max
Bank excess return	46	-0.01	0.05	-0.11	0.15
Exposure (B)	46	0.04	0.04	0.00	0.16
PIIGS (B)	46	0.02	0.03	0.00	0.15
non-PIIGS EMU (B)	46	0.01	0.02	0.00	0.08
non-EMU (B)	46	0.01	0.02	0.00	0.08
Government debt	46	78.13	27.29	41.40	126.80
Fiscal deficit	46	6.85	4.41	0.90	15.40
Sovereign CDS spread	46	163.99	217.21	26.49	751.38
Euro zone	46	0.70	0.47	0.00	1.00

Correlation matrix	Bank excess return	Exposure (B)	PIIGS (B)	non-PIIGS EMU (B)	non-EMU (B)	Gov debt	Fiscal deficit	Sov CDS spread	Euro zone
Bank excess return	1								
Exposure (B)	0.26*	1							
PIIGS (B)	0.50***	0.70***	1						
non-PIIGS EMU (B)	-0.16	0.46***	-0.13	1					
non-EMU (B)	-0.18	0.39***	-0.19	0.16	1				
Government debt	0.30**	0.43***	0.64***	-0.08	-0.16	1			
Fiscal deficit	0.40***	0.29**	0.59***	-0.27*	-0.15	0.56***	1		
Sovereign CDS spread	0.36**	0.47***	0.76***	-0.28*	-0.08	0.68***	0.75***	1	
Euro zone	0.47***	0.28*	0.39***	0.25*	-0.37**	0.56***	0.24	0.29*	1

Panel B. Sample for bank CDS spread change regressions

Descriptive statistics	Obs	Mean	Std. Dev.	Min	Max
Bank CDS change	32	-27.14	41.04	-166.06	11.77
Exposure (B)	32	0.03	0.03	0.00	0.16
PIIGS (B)	32	0.01	0.02	0.00	0.07
non-PIIGS EMU (B)	32	0.01	0.02	0.00	0.08
non-EMU (B)	32	0.01	0.01	0.00	0.04
Government debt	32	78.28	25.99	41.40	126.80
Fiscal deficit	32	6.83	4.27	0.90	15.40
Sovereign CDS spread	32	133.61	176.08	32.94	751.38
Euro zone	32	0.72	0.46	0.00	1.00

Correlation matrix	Bank CDS change	Exposure (B)	PIIGS (B)	non-PIIGS EMU (B)	non-EMU (B)	Gov debt	Fiscal deficit	Sov CDS spread	Euro zone
Bank CDS change	1								
Exposure (B)	-0.02	1							
PIIGS (B)	-0.37**	0.54***	1						
non-PIIGS EMU (B)	0.27	0.76***	-0.09	1					
non-EMU (B)	0.15	0.69***	-0.05	0.66***	1				
Government debt	-0.24	0.28	0.60***	-0.05	-0.18	1			
Fiscal deficit	-0.53***	0.01	0.43**	-0.29	-0.24	0.37**	1		
Sovereign CDS spread	-0.70***	0.20	0.69***	-0.29	-0.15	0.57***	0.65***	1	
Euro zone	-0.36**	0.33*	0.43**	0.16	-0.0734	0.61***	0.16	0.31*	1

Panel C. Sample for sovereign CDS spread change regressions

Descriptive statistics	Obs	Mean	Std. Dev.	Min	Max
Sovereign CDS change	18	-53.91	101.40	-387.43	0.03
Exposure (C)	18	0.11	0.08	0.01	0.33
PIIGS (C)	18	0.04	0.05	0.00	0.16
non-PIIGS EMU (C)	18	0.04	0.05	0.00	0.16
non-EMU (C)	18	0.03	0.03	0.00	0.08
Government debt	18	70.27	23.53	41.40	126.80
Fiscal deficit	18	6.66	4.16	0.90	15.40
Sovereign CDS spread	18	136.07	167.13	26.49	751.38
Euro zone	18	0.72	0.46	0.00	1.00

Correlation matrix	Sov CDS change	Expo- sure (C)	PIIGS (C)	non- PIIGS EMU (C)	non- EMU (C)	Gov debt	Fiscal deficit	Sov CDS spread	Euro zone
Sovereign CDS change	1								
Exposure (C)	-0.06	1							
PIIGS (C)	-0.60***	0.61***	1						
non-PIIGS EMU (C)	0.39	0.75***	0.06	1					
non-EMU (C)	0.23	0.39	-0.19	0.23	1				
Government debt	-0.59**	0.37	0.64***	0.06	-0.21	1			
Fiscal deficit	-0.67***	-0.01	0.48**	-0.29	-0.37	0.42*	1		
Sovereign CDS spread	-0.93***	0.15	0.63***	-0.29	-0.22	0.65***	0.65***	1	
Euro zone	-0.25	0.12	0.44*	0.13	-0.66***	0.38	0.21	0.19	1

Table 4. Determinants of bank excess returns

The dependent variable is the bank stock excess return over a five-day event window. Exposure (B), PIIGS (B), non-PIIGS EMU (B) and non-EMU (B) are a bank's net sovereign debt exposure relative to assets to all EU countries, PIIGS countries, non-PIIGS, EMU countries and non-EMU countries. Government debt is general government debt at the end of 2009 as a percentage of GDP in the country where the bank is headquartered. Fiscal deficit is the general government fiscal deficit in 2009 as a percentage of GDP in the country where the bank is headquartered. CDS spread is the five-year sovereign CDS spread on March 30, 2010 of the country where the bank is headquartered in basis points. Euro zone is a dummy variable that equals one if a bank is located in the euro zone, and zero otherwise. Robust standard errors clustered at the country level are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure (B)	0.338 (0.353)							
PIIGS (B)		0.726*** (0.132)	0.759*** (0.146)	0.611*** (0.144)	0.843*** (0.203)	0.865*** (0.136)	0.640** (0.272)	0.740*** (0.277)
non-PIIGS EMU (B)		-0.224 (0.480)	-0.223 (0.481)	-0.154 (0.515)	-0.275 (0.510)	-0.769* (0.428)	-0.805 (0.611)	-0.633 (0.532)
non-EMU (B)		-0.219 (0.306)	-0.224 (0.310)	-0.214 (0.308)	-0.194 (0.305)	0.072 (0.376)	0.282 (0.220)	-0.119 (0.587)
Government debt			0.000 (0.000)			0.001** (0.001)		
Government debt * Euro zone						-0.002*** (0.001)		
Fiscal deficit				0.002 (0.002)			0.005*** (0.001)	
Fiscal deficit * Euro zone							-0.007** (0.003)	
Sovereign CDS spread					0.000 (0.000)			0.000 (0.000)
Sovereign CDS spread * Euro zone								0.000 (0.000)
Euro zone						0.186*** (0.040)	0.086*** (0.031)	0.064*** (0.021)
Constant	-0.028* (0.016)	-0.023* (0.013)	-0.018 (0.037)	-0.032 (0.021)	-0.021 (0.015)	-0.110*** (0.033)	-0.074*** (0.017)	-0.062*** (0.017)
R ²	0.0686	0.2687	0.269	0.28	0.273	0.53	0.446	0.419
N	46	46	46	46	46	46	46	46

Table 5. Determinants of bank CDS spread changes

The dependent variable is the change in the bank CDS spread over a five-day event window. Exposure (B), PIIGS (B), non-PIIGS EMU (B) and non-EMU (B) are a bank's net sovereign debt exposure relative to assets to all EU countries, PIIGS countries, non-PIIGS, EMU countries and non-EMU countries. Government debt is general government debt at the end of 2009 as a percentage of GDP in the country where the bank is headquartered. Fiscal deficit is the general government fiscal deficit in 2009 as a percentage of GDP in the country where the bank is headquartered. CDS spread is the five-year sovereign CDS spread on March 30, 2010 of the country where the bank is headquartered in basis points. Euro zone is a dummy variable that equals one if a bank is located in the euro zone, and zero otherwise. Robust standard errors clustered at the country level are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure (B)	-22.19 (124.0)							
PIIGS (B)		-761.6** (307.1)	-718.9** (343.7)	-401.6 (541.1)	435.9 (467.7)	-596.2** (261.0)	286.0 (494.2)	659.7 (504.6)
non-PIIGS EMU (B)		587.206* (349.3)	600.7 (374.3)	409.7 (310.7)	106.9 (244.3)	933.9** (472.3)	155.5 (296.1)	348.5 (315.0)
non-EMU (B)		-176.7 (452.8)	-213.0 (405.0)	-326.7 (389.5)	11.728 (349.8)	-600.9 (641.7)	-142.8 (232.3)	-286.9 (471.0)
Government debt			-0.051 (0.454)			-0.006 (0.223)		
Government debt * Euro zone						0.334 (0.691)		
Fiscal deficit				-3.964 (2.780)			0.321* (0.171)	
Fiscal deficit * Euro zone							-9.077*** (2.723)	
Sovereign CDS spread					-0.193*** (0.022)			0.038 (0.108)
Sovereign CDS spread * Euro zone								-0.224** (0.112)
Euro zone						-57.76 (56.77)	26.54* (15.01)	-14.12 (14.96)
Constant	-26.39** (12.830)	-22.27* (11.450)	-18.76 (30.778)	2.971 (11.240)	-8.987 (10.160)	-4.873 (15.231)	-6.072** (2.602)	-6.817 (8.943)
R ²	0	0.196	0.196	0.323	0.518	0.303	0.565	0.577
N	32	32	32	32	32	32	32	32

Table 6. Determinants of sovereign CDS spreads

The dependent variable is the change in the 5-year sovereign CDS spread over a five-day event window. Exposure (C), PIIGS (C), non-PIIGS EMU (C) and non-EMU (C) are banks' net sovereign debt exposures to all EU countries, PIIGS countries, non-PIIGS, EMU countries and non-EMU countries aggregated to the country level and relative to GDP. In Panel A, government debt is general government at the end of 2009 as a percentage of GD. In Panel B, fiscal deficit is the general government fiscal deficit in 2009 as a percentage of GDP. In Panel C, sovereign CDS spread is the five-year sovereign CDS spread on March 30, 2010 in basis points. Euro zone a dummy variable that equals one if a country is in the EMU and zero otherwise. Standard errors are in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Panel A. Government debt as fiscal variable

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure (C)	-72.87974 (278.065)	247.3 (-214.4)				
PIIGS (C)			-1269.0* (652.4)	-806.7 (-603.3)		
non-PIIGS EMU (C)			906.6* (473.7)	938.6** (-460.9)		
non-EMU (C)			46.63 (450.29)	-86.0 (-490.6)		
Government debt		-2.841* (-1.523)		-1.576 (-1.341)	-2.540* (1.389)	-0.185 (0.173)
Government debt * Euro zone						-2.661 (1.737)
Euro zone						149.2 (115.7)
Constant	-45.89 (26.426)	118.5 (-87.8)	-42.21* (20.031)	52.20 (-76.3)	124.6 (85.04)	-3.194 (9.415)
R ²	0.003	0.378	0.543	0.620	0.348	0.387
N	18	18	18	18	18	18

Panel B. Fiscal deficit as fiscal variable

	(1)	(2)	(3)	(4)
Exposure (C)	-77.90 (-202.1)			
PIIGS (C)		-914.1 (-587.6)		
non-PIIGS EMU (C)		690.9 (-449.6)		
non-EMU (C)		-250.2 (-499.5)		
Fiscal deficit	-16.285** (-7.366)	-9.422* (-5.504)	-16.277** (7.286)	-0.058 (0.934)
Fiscal deficit * Euro zone				-20.56** (8.841)
Euro zone				91.67** (46.06)
Constant	63.05 (-48.66)	23.48 (-37.28)	54.424 (34.769)	-13.27** (5.753)
R ²	0.449	0.637	0.445	0.584
N	18	18	18	18

Panel C. Sovereign CDS spread as fiscal variable

	(1)	(2)	(3)	(4)
Exposure (C)	109.3 (108.6)			
PIIGS (C)		-170.4 (323.9)		
non-PIIGS EMU (C)		332.6** (145.9)		
non-EMU (C)		6.076 (240.3)		
Sovereign CDS spread	-0.570*** (0.042)	-0.503*** (0.076)	-0.563*** (0.039)	-0.092*** (0.020)
Sovereign CDS spread * Euro zone				-0.481*** (0.052)
Euro zone				24.99** (10.542)
Constant	11.678 (12.856)	7.248 (12.639)	22.68*** (6.673)	-5.617* (2.873)
R ²	0.867	0.881	0.861	0.890
N	18	18	18	18

Table 7. Estimated changes in market value of banks' sovereign debt holding, shares and liabilities

This table provides estimates of change in the values of sovereign exposures, bank liabilities and bank shares related to changes in values of PIIGS debts (in Panel A) and to changes in values of all EU sovereign debts (in Panel B). Figures are calculated for 32 banks that we have CDS spread data for and are aggregated to the country level. Figures are based on market movements in the five-day event window. dE PIIGS is the change in the market value of banks' PIIGS government bonds based on actual CDS spread changes. Predicted dB PIIGS is the predicted change in the market value of banks' liabilities due to PIIGS sovereign debt exposure based on regression 2 in Table 5. Predicted dMV PIIGS is the predicted change in banks' stock market value due to PIIGS sovereign debt exposure based on regression 2 in Table 4. dE Total is the change in the market value of banks' European government bonds, based on actual CDS spread changes. dB Total is the change in the market value of banks' liabilities based on actual bank CDS spread changes. dMV Total is the change in banks' stock market value based on actual stock market movements. Total assets of banks in sample is the sum of total assets of the 32 banks in the sample.

Panel A. Changes on account of PIIGS debt

Country	dE PIIGS (EUR millions) (1)	Predicted dB PIIGS (EUR millions) (2)	Predicted dMV PIIGS (EUR millions) (3)	Predicted dB PIIGS + Predicted dMV PIIGS (EUR millions) (4)
Austria	95	65	57	123
Belgium	961	1 629	459	2 088
Denmark	23	65	14	79
France	725	1 061	155	1 216
Germany	749	994	131	1 126
Netherlands	360	266	79	345
Sweden	48	54	27	81
United Kingdom	809	793	371	1 164
Portugal	517	321	95	416
Ireland	113	147	13	160
Italy	2 030	4 818	1 687	6 505
Greece	878	167	157	324
Spain	1 421	1 616	1 178	2 793
Total non-PIIGS	3 769	4 927	1 294	6 222
Total PIIGS	4 960	7 068	3 130	10 198
Total	8 729	11 995	4 424	16 419

Panel B. Changes on account of all sovereign debt

Country	dE Total (EUR millions) (1)	dB Total (EUR millions) (2)	dMV Total (EUR millions) (3)	dB Total + dMV Total (EUR millions) (4)	Total assets of banks in sample (EUR billions) (5)
Austria	203	69	60	129	577
Belgium	1 224	528	-1 821	-1 293	1 523
Denmark	74	222	-1 143	-921	860
France	933	12 720	1 613	14 333	9 627
Germany	966	3 525	-482	3 043	5 165
Netherlands	474	-922	701	-221	2 415
Sweden	121	787	-2 974	-2187	2 314
United Kingdom	1 202	882	-2 938	-2056	12 978
Greece	886	423	-23	400	257
Ireland	126	632	-41	591	362
Italy	2 157	1 773	-11	1 762	4 226
Portugal	528	2 323	264	2 587	474
Spain	1 434	6 013	2 826	8 839	2 305
Total non-PIIGS	5 199	17 812	-6 983	10 829	35 458
Total PIIGS	5 132	11 164	3 016	14 180	7 624
Total	10 331	28 976	-3 968	25 008	43 082

Figure 1. Average bank stock cumulative excess returns

Bank stock cumulative excess returns are weighted by total assets in 2009.

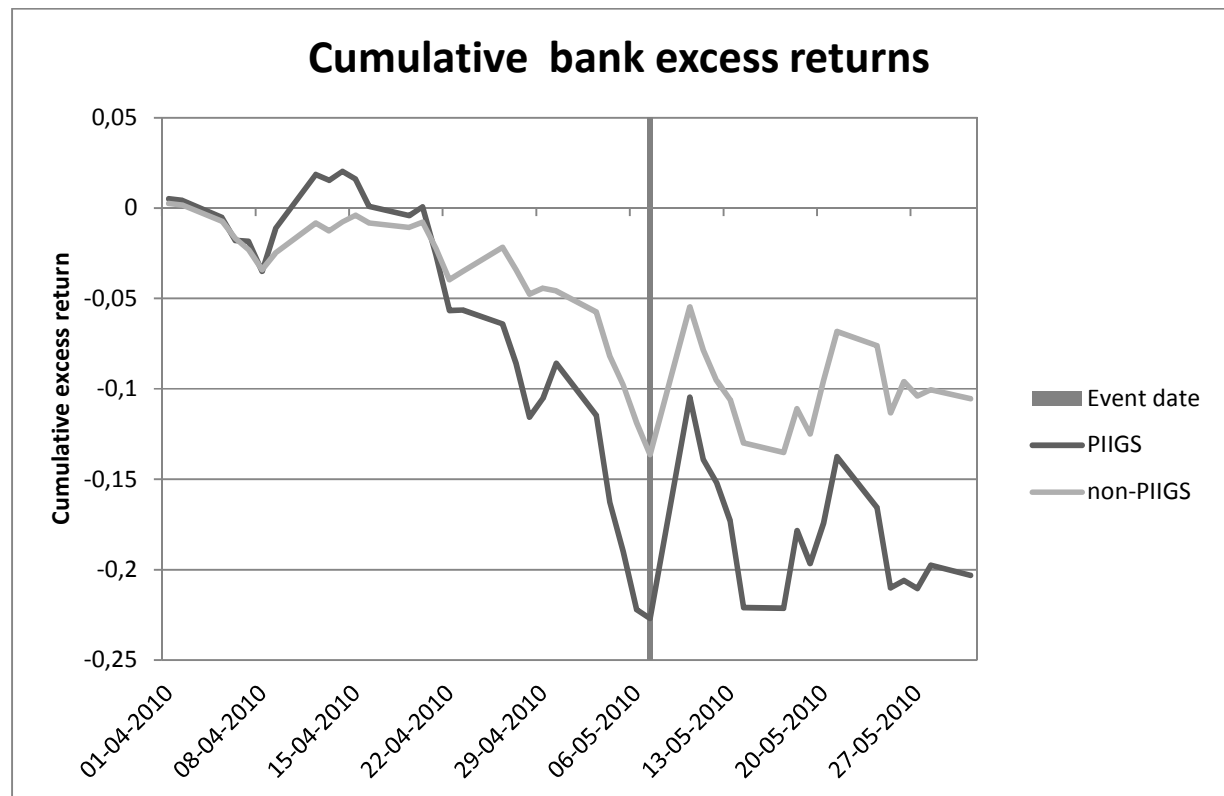


Figure 2. Average 5-year bank CDS spreads

Bank CDS spreads are weighted by total assets in 2009.

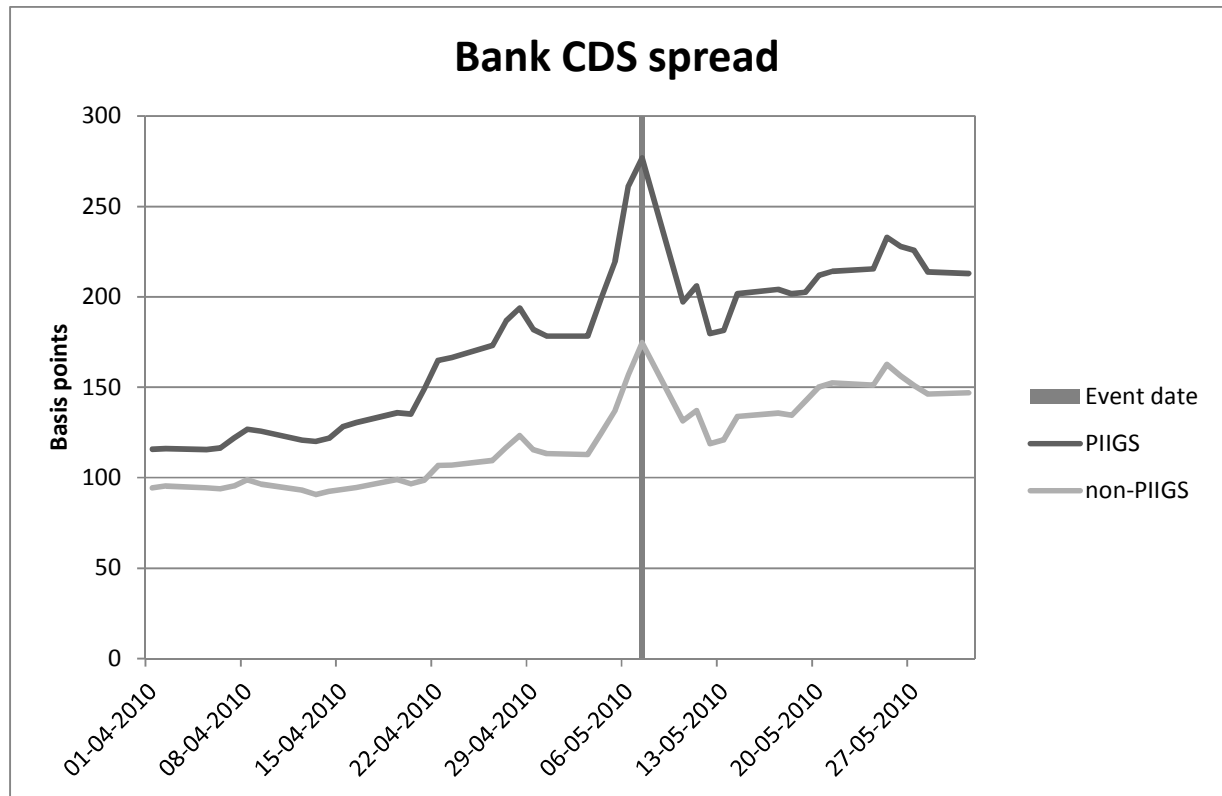


Figure 3. Average 5-year sovereign CDS spreads

Sovereign CDS spreads are weighted by general government debts at the end of 2009.

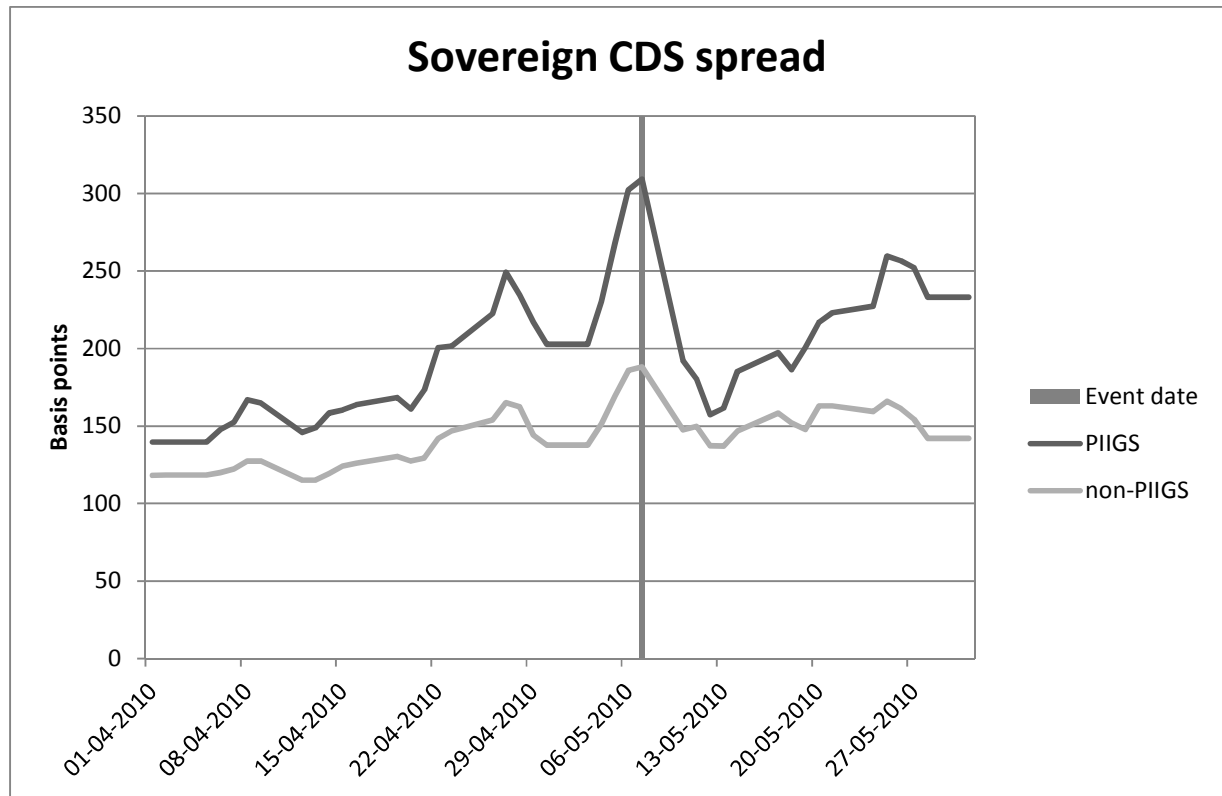


Figure 4. Mean bank stock cumulative excess returns, bank CDS spreads, and sovereign CDS spreads by country from April 1 to May 31, 2010

